$$i = \frac{dq}{dt} = -K'q_0 \quad (4)$$

where K' is the new constant of proportionality. K' depends upon the intensity of the electromagnetic radiation that reaches the insulator surface and hence on the contaminant absorption and the thickness. Therefore, the amount of the electromagnetic absorption of the contaminant directly affects the OSEE measurement of a charge-replenished insulator surface.

Consider an insulator or non-metal which is to be tested for contamination. The first step is to bombard the surface with high intensity ultraviolet radiation in the presence of an electric field to remove a large number of the available negative surface charges on the insulator surface. The next step is to immediately expose the insulator to an ion field sufficiently long that the surface no longer exhibits a net charge state. Now the insulator is ready for the OSEE-based measurement technique described above.

Many improvements, modifications and substitutions will be apparent to the skilled artisan without departing from the spirit and scope of the present invention as defined herein and desirable in the following claims.

We claim:

1. An apparatus for performing quality inspections on a test surface based on optically stimulated emission of electrons comprising:

(a) a light source for directing ultraviolet light onto the test surface;

(b) means for detecting a current of photoelectrons emitted from the test surface and generating a signal indicative of the photoelectron current, said means for detecting including a collector for collecting the photoelectron current and means for positively biasing said collector with respect to the test surface;

(c) means for indicating a condition of quality based on the generated signal indicative of photoelectron current; and

(d) means for negatively biasing said collector with respect to the test surface to replace charges removed as photoelectron current from the test surface by the previously positively biased collector.

2. The apparatus according to claim 1, wherein said light source directs a spectrum comprising discrete lines of ultraviolet light onto the test surface, the lines of the spectrum releasing photoelectrons from the test surface, and further comprising a light filter located between said light source and the test surface for permitting a selected spectrum line to pass through and for filtering out any other spectrum lines, wherein the selected spectrum line produces a majority of the photoelectron current produced by the spectrum.

3. The apparatus according to claim 1, further comprising means for supplying the test surface with a purge gas which is transparent to the ultraviolet light, does not alter the test surface, and does not participate in photochemistry.

4. The apparatus according to claim 1, further comprising an airtight enclosure surrounding the test surface, said light source and said detecting means; means for supplying the airtight enclosure with a purge gas; and means for circulating the purge gas through said airtight enclosure.

5. The apparatus according to claim 1, wherein said collector comprises a wire grid located between said light source and the test surface, said wire grid defining apertures for the ultraviolet light to pass therethrough, said wire grid oriented to form parallel electric field lines and constant potential surfaces.

6. The apparatus according to claim 1, further comprising means for determining a contact potential of the test surface.

7. The apparatus according to claim 6, wherein said contact potential determining means is a Kelvin probe.

8. The apparatus according to claim 1, further comprising:

a voltage source for powering said light source;

a detector for detecting the intensity of a particular wavelength of light directed by said light source onto the test surface and producing a signal indicative of the detected intensity; and

means for controlling the voltage of said voltage source in response to the signal indicative of the intensity of the particular wavelength to maintain the signal at a constant value indicative of a desired intensity of the particular wavelength of light.

9. The apparatus according to claim 1, further comprising:

an airtight housing located around said light source, said housing having a window which is transparent to the ultraviolet light of said light source; and

a gas circulation system for circulating a cooling gas through said housing to cool said light source, the cooling gas being transparent to the ultraviolet light of said light source.

10. The apparatus according to claim 8, further comprising:

an airtight housing located around said light source, said housing having a window which is transparent to the ultraviolet light of said light source; and

a gas circulation system for circulating a cooling gas through said housing to cool said light source, the cooling gas being transparent to the ultraviolet light of said light source.

11. An apparatus for performing quality inspections on a test surface based on optically stimulated emission of electrons comprising:

(a) a light source for producing and directing ultraviolet light onto the test surface;

(b) means for detecting a current of photoelectrons emitted from the test surface and generating a signal indicative of the photoelectron current, said means for detecting including a collector for collecting the photoelectron current and means for positively biasing said collector with respect to the test surface, wherein the collector comprises a window transparent to the ultraviolet light directed by said light source, a metal layer coated on the window which is partially transparent to the ultraviolet light directed by said light source; and

(c) means for indicating a condition of quality based on the generated signal indicative of photoelectron current.

12. A method of performing quality inspection on a test surface based on optically stimulated emission of electrons comprising the steps of:

directing ultraviolet light on the test surface;

positively biasing a collector with respect to the test surface to collect the photoelectrons emitted from the test surface, whereby a certain charge is removed from the test surface;

measuring the current of photoelectrons emitted from the test surface;